Determining the optimal place and time for procedural education

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JUST-IN-TIME PERFORMANCE SUPPORT AS AN EDUCATIONAL PROCESS

In an apprenticeship model, for a trainee who is developing their skills, situating them in the workplace has distinct advantages. Starting from legitimate peripheral participation, the developing clinician is moulded by social interaction and collaboration while they learn from the spectrum of patients that make up a given clinical population.[1] The goal is lasting behavioural and cognitive changes in the trainee as they take up the mantle of 'expert clinician'.

However, to take on legitimate roles in the clinical workplace, a trainee requires direct just-in-time support, or 'scaffolding', in the form of supervision. Their preceptors provide enough support to ensure that safe and successful patient management can be accomplished. This is analogous to training wheels for someone learning to ride a bicycle—a scaffolding mechanism that enables a relative novice to perform the activity from start to finish when they otherwise would not have been able to.[2] A novice such as a medical student requires considerable support and so leans considerably on the training wheels. As the learner progressively develops as a practitioner, they will require less and less scaffolding.[3] The training wheels are used less and less. The preceptor, in an ongoing process, will continually monitor the nature and quantity of support the learner requires and, in a process known as *fading*, appropriately decrease the amount of scaffolding provided.[3 4] Once proficient, the trainee functions at an expert level so that the training wheels can be removed entirely… or can they?

In this issue of *BMJ Quality & Safety*, Branzetti *et al* describe an educational programme aimed at ensuring that practising physicians properly accomplish the rare but important task of transvenous pacing.[5] This is a skill taught and mastered during Emergency Medicine residency; however, the component steps are numerous and complicated—difficult to retain over what can be years between cases. They describe their system of just-in-time scaffolding designed to overcome the forgetting curve associated with complex skills(figure).

JUST-IN-TIME PERFORMANCE SUPPORT AS A QUALITY PROCESS

High quality clinical care requires that even expert clinicians be supported in their performance by information and knowledge systems. One of the important adjustments made necessary (and, indeed possible), by the implementation of modern clinical information systems is the intentional planning of where to embed which forms of cognition, a process sometimes referred to as *distributed cognition* where the community decides at a system level what different types of knowledge are best embedded where.[7] Computers are tasked with maintaining and presenting knowledge that requires, for example, prodigious memory capacity freeing up humans to devote more time to tasks only they can do well (eg, interviewing the patient).

This flexible delivery of knowledge/cognitive resources can be facilitated by expressly designed systems termed 'clinical decision support'[8] or, more generally, electronic performance support systems'. These systems are concerned with the organisation, synthesis and presentation of the resources necessary for a given clinical action. A classic example would be drug dosing information which, prior to the implementation of modern information systems, would have depended on the memory of the clinician or on paper materials they carried with them.

The study by Fernandez *et al* demonstrates an important aspect of distributed cognition. Namely, the distribution

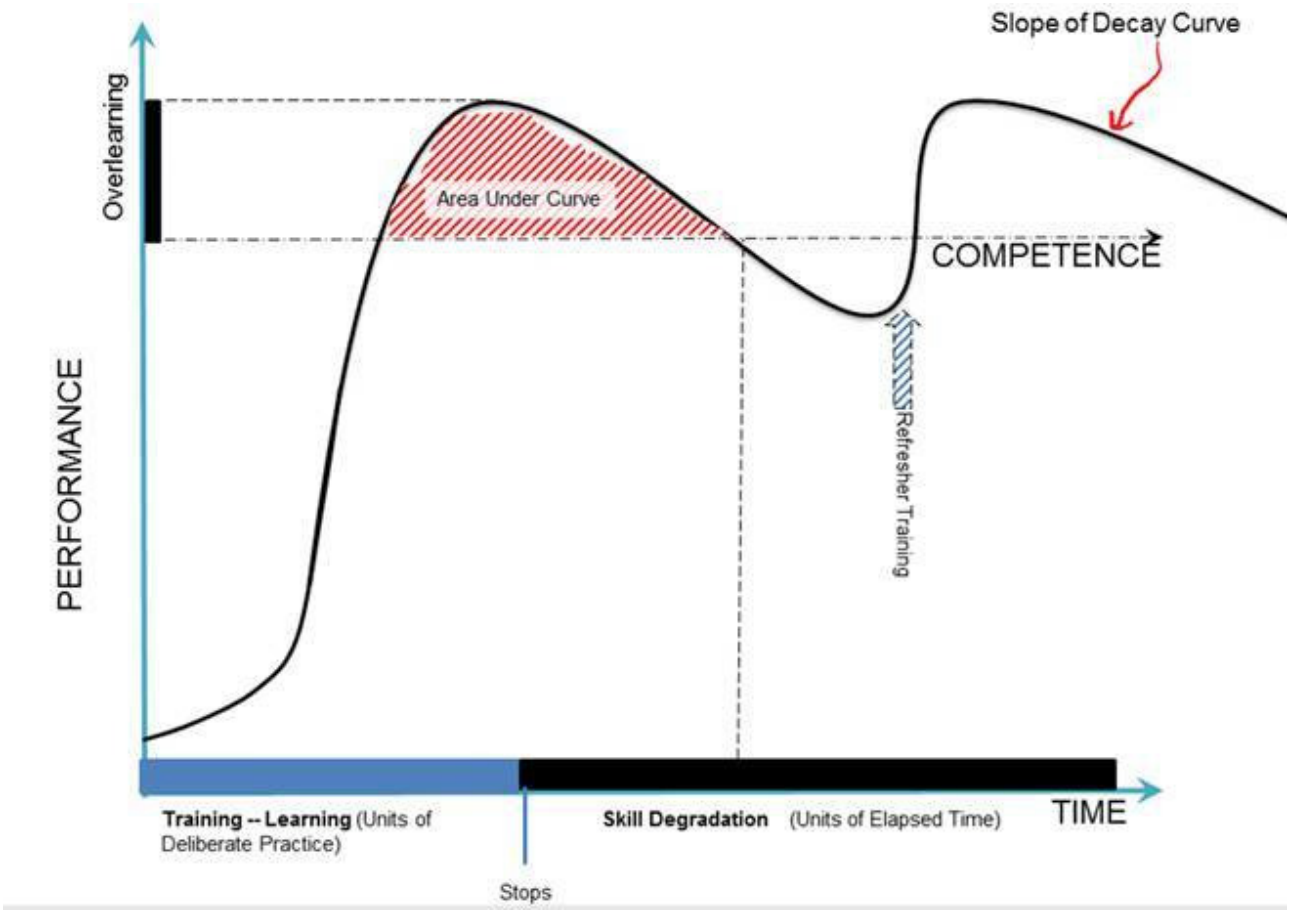

Figure 1 Experience curves showing distributed cognition. In this figure, the level of skill achieved by a developing clinician increases quickly during a training programme, but decays when a particular skill is not used by the practitioner. Such a joining of the learning curve with the forgetting curve is termed an experience curve. When taking this into account when designing a system of care, a key decision is when and how to deploy refresher training or performance support (adapted from Pusic *et al*).[6]

of cognition by an electronic performance support systemcan be organised not only by *where* the cognition takes place, but also by *when*.The investigators designed an educational intervention that embedded part of the cognition necessary to accomplish transvenous pacing within a certain person (as a permanent memory or skill developed in the clinician during residency, requiring considerable training and maintenance energy) and embedded part of the cognition that would be applied by that individual to the specific time when the procedure would take place, potentially years between the initial training or between repetitions. This is instead of frequent continuing medical education required to fight the forgetting curve that is associated with maintenance of skill in such a complex, time-pressured procedure.[5] In this way, there is the potential for more efficient use of educational and clinician resources in service of a higher quality outcome.

THE BLURRING OF THE LINE BETWEEN PERFORMANCE SUPPORT AND EDUCATION

In modern clinical care, high quality requires a highly educated clinician combined with a performance support system, where each is optimised so that the patient receives the right care at the right time. The transvenous pacing example provided by Fernandez *et al*[5] is instructive in forcing us to consider which part is best developed by the educational system (training of a resident, maintenance of competence in an expert clinician) and which is best embedded in the clinical care system (just-in-time performance support).

In a distributed cognition system, we can rethink the division between education (typically offline, aimed at permanent change in the trainee) and performance support (inline, transient). Moving knowledge or learning closer to the patient is sometimes the most efficient and effective strategy, as suggested by the example of transvenous pacemaker insertion. Meanwhile, designing foundational health professions' education, such that the graduating clinician can explicitly take full advantage of performance support mechanisms, constitutes a promising new frontier, allowing us to develop not just a 'systems-aware' practitioner but rather a 'systems-enabled' one.

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